FLIGHT

First Aero Weekly in the World.

Founder and Editor: STANLEY SPOONER.

A Journal devoted to the Interests, Practice, and Progress of Aerial Locomotion and Transport.

OFFICIAL ORGAN OF THE ROYAL AERO CLUB OF THE UNITED KINGDOM.

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With regard to photographs and descriptions of new British machines and those of our Allies, and other information which may be of help to our enemies, it should be noted that the Editor of FLIGHT, *in the National interest, submits all matter of this character to the Official Press Censor before publication. Hence our readers will appreciate that many new departures in construction or advances in detail work are necessarily held back for the present rather than the smallest risk should be run of helping those who are so strenuously fighting the Allies for the enforcement of their "Kultured" militarism.*—ED.

EDITORIAL COMMENT.

More Honour for Our Flying Officers.

Once again it is extremely gratifying to be able to record special honours being conferred upon officers of the Royal Flying Corps for services which, as individual performances, stand out as achievements worthy of being permanently recorded amongst the great deeds during the present war. In this connection the number of casualties which we have had to record lately, and especially the comparatively lengthy list which appears in this issue, brings it home to all what the hazards of the "fifth arm" are developing into. Reverting to the list of honours, it will be noticed that in three out of the four cases which now receive recognition, the particularly fine airmanship was mainly constituted by the destruction of important railway stations and junctions in the hands of the enemy, besides extremely hazardous work in special reconnaissance flights. In these, far-reaching consequences have resulted from the information the officers were able to obtain of the position of German batteries, and in directing artillery fire under extremely dangerous conditions. In the case of Lieut. Carmichael, to ensure that his bombs went home on the Menin railway station, he, in spite of the most violent attacks, deliberately descended to within 120 feet of his object, but was able to return safely although his engine was damaged during his attack. Lieut. Pretyman was responsible for the destruction recorded recently at Don station, where he, in addition, drove off a German aeroplane which attempted a counter attack on him, whilst he also on the day before executed a splendid reconnaissance along a very extended portion of the German positions, ascertaining important movements which were going on, during the whole of which time he was under very heavy fire. Both these officers have now received the Distinguished Service Order. The other two officers honoured in the present list receive the Military Cross. The one, Lieut. W. R. Freeman, on the 10th ult. located the position of the German batteries, which it was important should be ascertained, conveying the information by wireless messages to the artillery, and although his propeller and planes were seriously pierced by the enemy's bullets, he kept at his task for more than five hours. Second Lieut. L. A. Strange was responsible for the damage done at Courtrai railway junction, upon which occasion he got home three bombs from a height of 200 ft. only. These are mere episodes in this great war, and without doubt, in a lesser degree, perhaps, many feats of fearless bravery, which with opportunity might easily be worthy to be classed with the work of these officers, are being carried out a dozen times a day at various parts of the battle-line. It will be remembered that in the official report issued recently in connection with the Neuve Chapelle battle, it was specially pointed out that the effective work of the artillery was in no small measure due to the services of the flying officers. In the misty weather that prevailed then little could be seen by the pilots from a height at which they were even comparatively safe, but they did not hesitate to accept the greatest risks by descending to a height of only 800 feet above the enemy's batteries. Such a low altitude in itself is sufficiently risky to entitle the men engaged in having their names specially recorded, and it will therefore be the more appreciated what the officers to whom reference is made above have accomplished, when the specially low altitudes at which they carried out their raids are taken into consideration. No doubt when the daring air

raid on Antwerp which took place last week, in which Squadron-Commander Ivor T. Courtney and Flight-Lieut. H. Rosher managed to drop four bombs each on the submarines in course of erection at Hoboken, comes to be considered in detail, we may have occasion to record further honours in favour of these successful officers, who, to ensure hitting the objective for which they took their hazardous flight, risked their chance of fatal consequences by descending, over a perfect maze of anti-aircraft guns, to 1,000 ft. It is well that the outstanding services of the Royal Flying Corps are thus again quickly acknowledged, as although war aviation is hardly yet born, it is encouraging to be able to look forward, under the circumstances, with the greatest confidence to its becoming as vast in its own special sphere, and of corresponding importance to Great Britain, as the Navy hitherto has ranked.

BRITISH AERIAL SUPREMACY.

TIME and again when there have been adverse articles in the Press upon the future of aviation, we have not unnaturally strongly protested against the belittling of so great a science, and pointing out the enormous possibilities which were in store for a British aeronautic industry, if only it were sufficiently encouraged, and in good time. Of course the reply in many cases in those days—*now* we think there are few who fail to grasp its importance—was that we were prejudiced, and as a rule it had to go at that. But time, and the present European upheaval, have been on our side, and there can be no manner of doubt but that the science of aviation will bring about one of the greatest revolutions in certain directions that the world has ever witnessed. There is little need now for us to sound the trumpet of appreciation. Writers in every direction vie with each other in pointing the moral of the necessity for our supremacy in the air. And we are right glad to welcome this evidence of awakening—even though it has been tardy. These reflections are but an introduction to drawing attention to a remarkable article in the *Evening Standard* upon the establishment of British aerial supremacy, by Colonel F. N. Maude, C.B., than whom, we are of opinion, there is no more able critic in the daily Press upon the progress and prospects of the present war. Had the opinions emanated from FLIGHT, they would have been regarded by the uninformed man in the street as wildly extravagant. But coming from so eminent an authority as Col. Maude, the expressions of conviction as to the future triumph of the British Air Services, must carry conviction with the general public who have any appreciation of men who know. The following is the main portion of Col. Maude's tribute of about a fortnight ago :—

"The situation which exists along the fighting front from Flanders to the Rhine has no parallel in all military history. Even six months ago not the most sanguine believer in the future of aircraft could have dared to prophesy what has actually come to pass.

"Naturally it was quite clear that if one army was equipped with reliable flying machines while the opponents' were not, the advantages to the former must be very considerable ; but no one expected that as between the Great Powers of Europe, any one Power or group of Powers could establish such an ascendancy as to control the air, for all practical purposes, as if no enemy aircraft were to be feared in opposition. Yet this is what is happening in France, and the consequent gain to the Allies is extraordinary.

"From the moment that they, in their advance from the Marne, found themselves confronted by an overwhelming number of siege guns, they decided to outbuild and out-class their adversaries, both in number of guns and stores of ammunition, and substantially the time required by the artillery manufacturing establishments has been one of the principal causes of the long delay in turning the Germans out of France and Belgium.

"Meanwhile the triumphant reign of our airmen, which increases with every month, ... has completely altered the nature of the problem before us, and has rendered it possible to obtain entire superiority over the enemy artillery.

"It is this factor, which was quite unforeseen, indeed unforeseeable, that now dominates everything else, and enabled us to claim, in the words of the French official report published last week, that 'recent operations (about Beausejour, Perthes, and so forth understood) show that at a given point, and at a given hour, we are free to do what we will.'

"It means, briefly, that even while we have been waiting for the accumulation of the stores necessary for our attainment of the desired degree of supremacy, that supremacy itself—unconditional and unevadable—has quietly fallen into our hands, almost without conscious volition. From this time onward we can make the enemy reserves dance to our tune, the power which every general has always desired, but none before has ever obtained.

"If we want to draw a German reinforcement from west to east, or *vice versa*, we have only to develop an attack—as, for instance, between the two points above-named—threatening the lateral lines of communication, and the German Staff must rush up troops to answer our offensive, and go on spending their men in wasteful counter attacks, on pain of a loss which would presently compel a concentration to the rear.

"This has all along been the inner meaning of the almost daily reference in the *communiqués* to 'artillery duels, in which we obtained a superiority,' or similar phrases; but the ultimate consequences which must ensue from the acquisition of such a complete artillery ascendancy are so overwhelming that one has never quite dared to formulate, even in one's own mind, all the changes in the conduct of warfare on land which must follow what is primarily due to our conduct of war in the air.

"The one thing which is certain is that we can never afford to allow this advantage to slip from our grasp. We must go on building and perfecting aeroplanes and training pilots with all possible energy, and should red tape and official lethargy intervene, then this is one of the cases where private capitalists might come to the front and find the means to double and treble our flying squadrons."

Last week, Col. Maude returned to his subject when dealing with the all-important question raised by Lord Kitchener on the lack of supplies. After pointing out that no foresight could have foreseen the extraordinary demands which the war has made on Britain, Col. Maude remarks that firstly the bad weather has helped us by giving us time to adapt ourselves to the great upheaval from peace to war, and then continues as follows :—

"Next in importance comes the ascendancy gained by our flying men, both French and British—a factor we certainly never counted upon when our first estimates of the resources of all kinds necessary for the campaign were made.

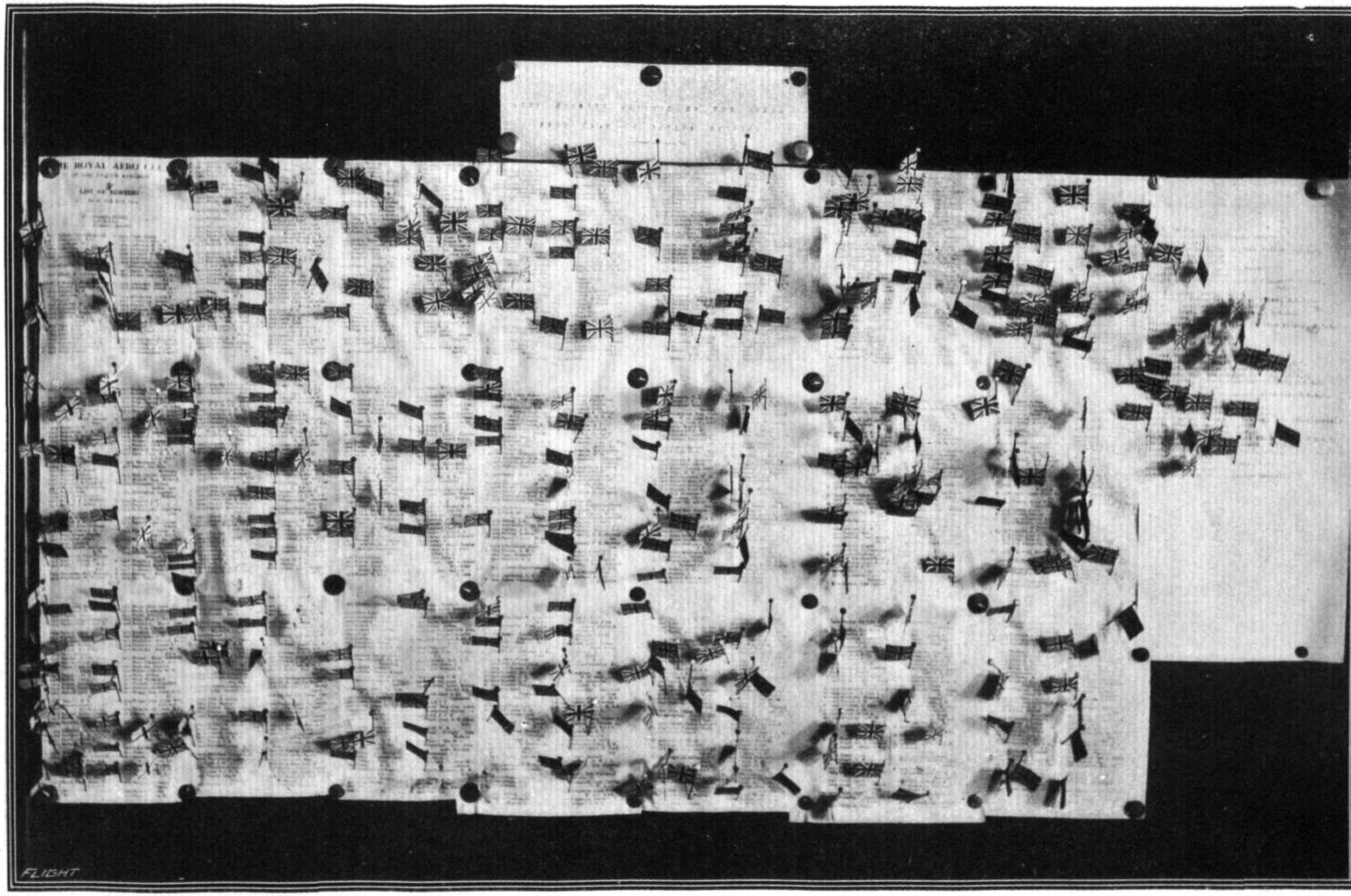
"The effect of this flying conquest must be to diminish enormously the expenditure of ammunition, great and small, needed to achieve our particular purpose on each and every field of land action, and against this advantage the enemy has nothing efficient to oppose.

"The sequence of cause and effect runs as follows : If, thanks to our aeroplanes, we can locate or knock out the enemy's big guns in ten rounds instead of a hundred, we not only save ninety rounds of ammunition, but are free to turn on the enemy trenches the more quickly. Again, thanks to aeroplanes, we can either smash them more completely, because of better shooting for the same number of rounds, or at least overpower the enemy sufficiently for a lesser number of shots and in less time.

"A shorter time is here the most important advantage of the two, for the attack then comes more in the nature of a surprise, and the enemy's reserves will therefore probably come up too late to be of any use.

"In either case the presumption is that our infantry will use less ammunition and obtain greater results in each particular engagement. The success of the Neuve Chapelle attack is a case in point.

"Good shooting made such a living hell of the enemy position that where not obstructed by wire our men carried their first objective in a few minutes, hardly needing to shoot at all, and they then proceeded to inflict a perfectly terrible punishment on the counter-attacking enemy."



HOW MEMBERS OF THE ROYAL AERO CLUB ARE HELPING TO KEEP THE FLAG FLYING.—This photograph is of a list of members of the Club which hangs in the Club smoking-room in 166, Piccadilly. Every flag denotes that the member against whose name it stands is on active service in the present war. Truly a splendid record.

AIRCRAFT WORK AT THE FRONT.

OFFICIAL INFORMATION.

IN the account dated March 16th, from an "Eye-witness" present with the British Headquarters, dealing with the fighting round Neuve Chapelle, it was stated :—

"The effective co-operation of our artillery was due in no small measure to the services of our airmen. In the misty weather that prevailed little could be seen by the latter from a height at which they were comparatively safe, and they did not hesitate to accept the greatest risks by descending to a height of only 800 ft. above the hostile batteries."

In the subsequent despatch, dated March 23rd, there was the following :—

"On Monday, the 22nd, besides other results recorded in the last Summary, we succeeded in destroying one of the German anti-aircraft weapons which had been annoying our aviators."

In a *communique* relating to the skirmish in the desert 10 miles to the east of Kubri on March 23rd, there was the following :—

"Aeroplane reconnaissances show that the Turkish Force has retreated to Nekhl."

In the evening *communique* issued in Paris on March 26th it was stated :—

"Six of our aviators bombarded the airship sheds of Frescaty and the station of Metz. They dropped a dozen bombs, which caused a panic. Although exposed to a violent cannonade, they all returned in safety. We also bombarded the barracks to the east of Strassburg."

In the afternoon *communique* issued in Paris on March 27th there was the following :—

"A German aeroplane threw several bombs on Willer (north-west of Thann), and three little children were killed.

"The number of aviators mentioned in last night's *communique* should be ten, not six."

In the evening *communique* issued on the same day it was stated :—

"A German aeroplane which had thrown a bomb in the region of Manonviller was brought down by us. The pilot and the observer were captured."

In the afternoon *communique* issued in Paris on Sunday there was the following :—

"The Belgian aviators bombarded the aviation camp at Ghistelles."

In a *communique* issued in Petrograd on the 25th ult. there was the following :—

"On the Dunajetz we hit an enemy aeroplane, but did not succeed in capturing it, as it fell among the enemy's lines."

In an official note issued in Petrograd on the 27th ult. there was the following :—

"At Ossowiec the Germans made several attempts to send up a captive balloon, but our artillery hit it at once."

In a *communique* issued in Petrograd on Monday regarding the bombardment of the Bosphorus forts it was stated :—

"The Russian aviators flying above the Bosphorus batteries carried out reconnaissances and dropped bombs with success."

The following official telegram was received by Sir J. Roper Parkington, Consul-General for Montenegro, from Cettinje on the 25th ult. :—

"Three Austrian aeroplanes passed over Antivari at six o'clock on the morning of the 23rd throwing sixteen bombs, one of which fell on the Government tobacco warehouse, destroying the roof. Virbazar was also attacked with bombs, damaging the railway station. A further attack was made on the Montenegrin positions at Lovtchen, both by bombs and machine-guns, the latter firing wooden arrows with steel points."

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WAR HONOURS.

IN a supplement to the *London Gazette* issued on Saturday evening it was announced that the King had been graciously pleased to approve of the appointment of the undermentioned officers to be Companions of the Distinguished Service Order, in recognition of their gallantry and devotion to duty whilst serving with the Expeditionary Force :—

Lieut. (Temporary Captain) George Ivan Carmichael, Royal Artillery and R.F.C.

For conspicuous gallantry, daring, and ability throughout the campaign. On the 11th inst. he destroyed the rails at Menin railway station by dropping a bomb, weighing 100 lbs., thereon from a height of only 120 ft. On the return journey his engine was damaged by a bullet which necessitated his flying at a height of less than 200 ft. Captain Carmichael has also rendered valuable services in observing artillery fire.

Lieut. (Temporary Captain) George Frederick Pretyman, Somerset Light Infantry and R.F.C.

For great gallantry, ability, and initiative on numerous occasions, especially on the 12th inst. The clouds being low he had to fly very low for a considerable period all along the German positions to ascertain their movements, being exposed the whole time to a very heavy fire.

On the 13th inst. he blew up the centre of a train at Don station, damaged a building outside which a battalion of the enemy were forming up, and drove off a German aeroplane.

It was also announced that His Majesty the King had been graciously pleased to confer the Military Cross on the undermentioned officers in recognition of their gallantry and devotion to duty, whilst serving with the Expeditionary Force :—

Lieut. W. R. Freeman, Manchester Regiment and R.F.C.

For gallantry, ability, and very valuable work performed.

Located the position of German batteries on 10th instant, and conveyed the information by wireless messages from his aeroplane to our Artillery, and, although his propeller and planes were pierced by the enemy's bullets, he remained aloft for more than five hours during the day.

Second Lieut. (Temporary Captain) L. A. Strange, Dorsetshire Regiment and R.F.C.

For gallantry and ability on reconnaissance and other duties on numerous occasions, especially on the occasion when he dropped three bombs from a height of only 200 ft. on the railway junction at Courtrai, whilst being assailed by heavy rifle fire.

THE ROLL OF HONOUR.

THE following casualties in the Royal Flying Corps attached to the Expeditionary Force have been officially notified by the War Office :—

In the lists issued on March 26th :

Died as the Result of an Accident.

Capt. C. S. Rich, Royal Field Artillery, attached R.F.C.

Missing.

Second Lieut. T. E. H. Davies, King's Royal Rifle Corps and R.F.C.

Lieut. G. N. Humphreys, R.F.

In the lists issued on Saturday :

Missing.

Lieut. G. W. Mapplebeck, King's (Liverpool Regt.) and R.F.C.
Lieut. A. St. J. N. Warrand, the Black Watch and R.F.C.

Interned in Holland.

Lieut. G. H. Eastwood, R.F.C.
Second Lieut. J. C. Joubert de la Ferte, R.F.C.
Capt. F. E. Fryer, Royal Garrison Artillery and R.F.C.

The following casualty in the Indian Expeditionary Force was reported under date March 24th :—

Officer Interned in Holland.

Lieut. D. M. V. Veitch, 1st Lancers, attached R.F.C.

The following was reported from Egypt :—

Died.

Lieut. S. P. Cockerell, R.F.C.

The following casualty was reported from the base of the Expeditionary Force under date of March 11th :—

Died.

1307 2nd Air Mechanic A. C. Hawkins, R.F.C.

THE BRITISH AIR SERVICES.

Royal Naval Air Service.

THE following announcement was made by the Admiralty on the 24th ult. :—

A. E. Gendle granted a temporary commission as Lieutenant, R.N.V.R., and appointed to the "President," additional, for Royal Naval Air Service. To date March 23rd.

R. M. Wynne-Eyton and W. E. Slingsby granted temporary commissions as Sub-Lieutenant, R.N.V.R., and appointed to the "President," for duty with R.N.A.S. To date March 23rd.

The following announcement was made by the Admiralty on the 27th ult. :—

Temporary Sub-Lieuts. (R.N.V.R.) S. M. Cleverley, A. L. Braithwaite, and M. Birkbeck, all promoted to Temporary Lieutenants (R.N.V.R.), with seniority of March 24th, and reappointed to "President," additional, for duty with the R.N.A.S.

A. V. Thompson, granted a temporary commission as Lieutenant, Royal Naval Volunteer Reserve, with seniority of March 22nd, and appointed to "President," additional, for duty with R.N.A.S.

The following announcement was made by the Admiralty on the 29th ult. :—

Acting Flight-Commander F. K. McClean, confirmed in the rank of Flight-Commander, with seniority Feb. 2nd, and promoted to the rank of Acting Squadron-Commander. To date Feb. 18th.

Royal Flying Corps (Military Wing).

THE following appeared in a supplement to the *London Gazette* published on the 24th ult. :—

Special Reserve. Supplementary to Regular Corps.—John W. Woodhouse to be Second Lieutenant (on probation). March 12th, 1915.

The following appeared in a supplement to the *London Gazette* published on the 25th ult. :—

Corp. D. K. Johnstone, Bombay Light Horse, to be temporary Second Lieutenant for service in the Field, and to be retained for service with the Royal Flying Corps. Feb. 26th, 1915.

Special Reserve. Supplementary to Regular Corps.—Harold Burchall to be Second Lieutenant (on probation). March 19th, 1915.

The following appeared in the *London Gazette* issued on the 26th ult. :—

The undermentioned Flight-Commanders to be Squadron-Commanders, with the temporary rank of Major ; dated March 17th, 1915 :—Capt. G. E. Todd, Welsh Regt., and Capt. H. C. T. Dowding, Royal Artillery.

The undermentioned Flying Officers to be Flight-Commanders, with the temporary rank of Captain ; dated March 17th, 1915 :—Lieut. H. D. Harvey-Kelly, D.S.O., Royal Irish Regt., and Lieut. W. R. Freeman, Manchester Regt.

Special Reserve. Supplementary to Regular Corps.—The undermentioned to be Second Lieutenants (on probation) :—S. W. Caws ; dated February 25th, 1915. A. Graham Clark ; dated March 24th, 1915.

The following appeared in a supplement to the *London Gazette* issued on the 29th ult. :—

Special Reserve. Supplementary to Regular Corps.—Second Lieut. H. C. Barber to be Lieutenant. March 16th.

The undermentioned Second Lieutenants (on probation) are confirmed in their rank : R. Orme, G. C. R. Mumby, L. M. Wells-Bladen, A. Huggins, F. Jolly, J. E. Storey, S. C. Callaghan, the Hon. E. A. Stonor, T. V. Smith, R. B. Bourdillon, and G. H. B. McCall.

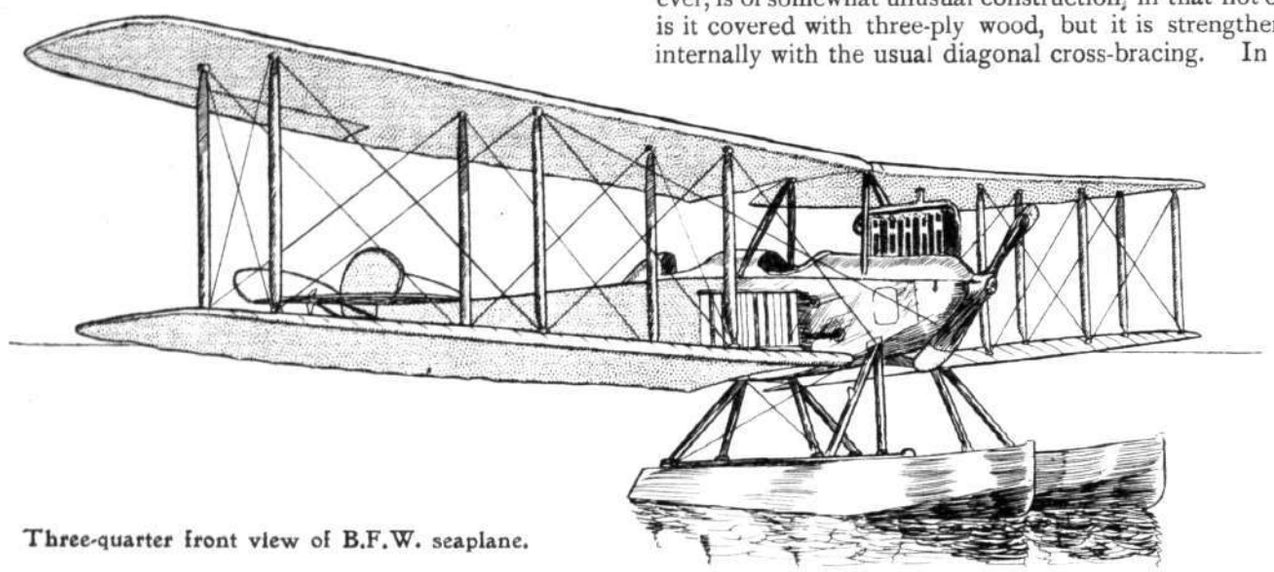
S. H. B. Harris to be Second Lieutenant (on probation). March 9th.

AN UP-TO-DATE MOTOR MASCOT.—The British Lion *versus* Germany's Zeppelin—a toothsome prize.

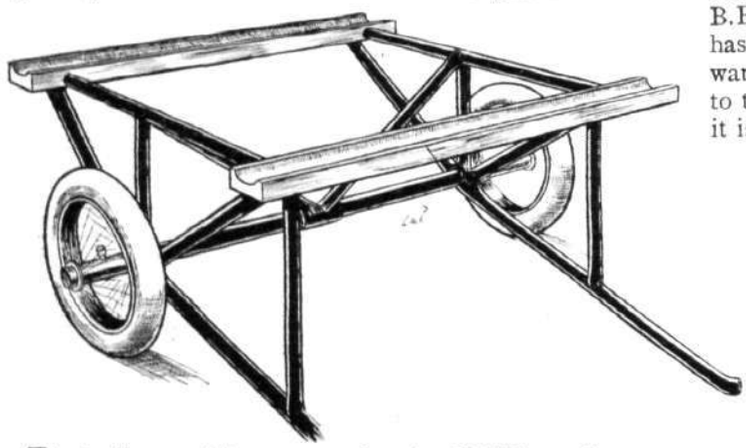
ANOTHER GERMAN SEAPLANE.

THE B.F.W. (BRANDENBURGISCHEN FLUGZEUGWERKE).

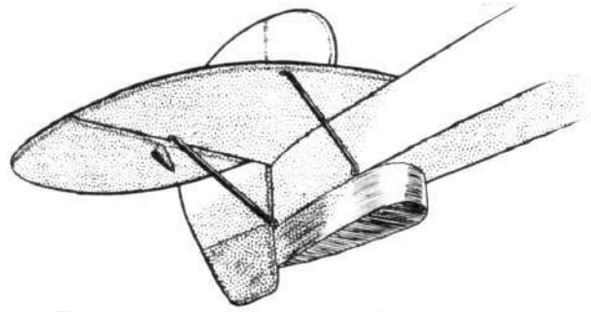
SINCE giving a description of some of the seaplanes entered for the Warnemünde–Scandinavia Seaplane Race, which was postponed on account of the war, the following particulars are to hand of another machine designed specially for this contest—the B.F.W. seaplane. In its general lay-out, this machine follows the lines of other German biplanes of the tractor type, with which our readers are already familiar, having a rectangular section body, tapering almost to a point in the nose, where is housed the 150 h.p. Benz motor. The *fuselage*, however, is of somewhat unusual construction, in that not only is it covered with three-ply wood, but it is strengthened internally with the usual diagonal cross-bracing. In the Albatros, it will be remembered, no internal cross-bracing of any sort is employed, the necessary stiffness being provided by the three-ply covering. In the B.F.W. seaplane the internal cross-bracing of the body has been employed to better prevent the *fuselage* from warping under the action of sea water. The resemblance to the Albatros biplanes will be easily understood when it is pointed out that this machine was built by Ingenieur Heinkel, who was formerly chief engineer to the Albatros firm. In the front portion the body is covered with a turtle-back of three-ply wood, finishing off behind the



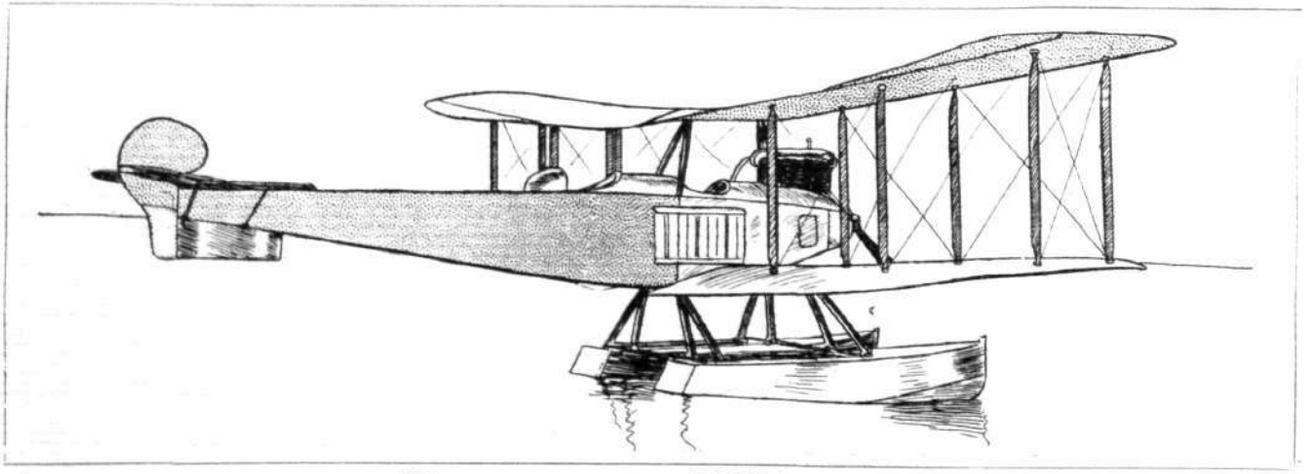
Three-quarter front view of B.F.W. seaplane.



The trolley used for transporting the B.F.W. seaplane from its hangar down to the beach.



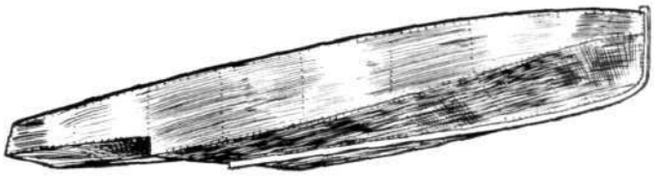
Tail planes and float of B.F.W. seaplane.



Three-quarter rear view of B.F.W. seaplane.

pilot's seat in a tapering shape somewhat similar to that found on the Deperdussin racing monoplanes, and evidently intended to form a streamline continuation of the pilot's head. Immediately behind the engine is placed the observer's seat, and between him and the pilot are mounted the fuel tanks. The radiators, which are of the usual type, are mounted one on each side of the body.

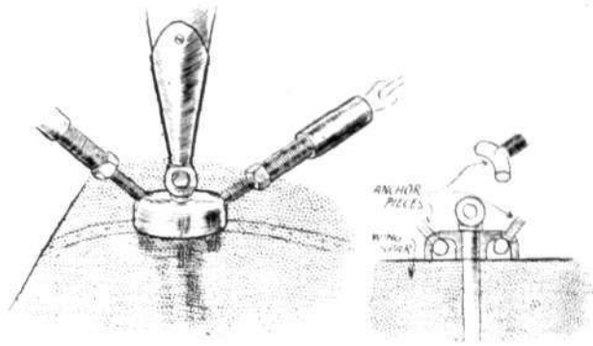
Carried on a structure of steel tubes are the two main floats, which are of large size and placed fairly close together. In front the floats are of the V-bottom type, flattening out gradually towards the step, which occurs approximately under the centre of gravity of the machine. Immediately behind the step the float bottom is perfectly flat, gradually running into a slight V-bottom at the stern.



View from below of one of the main floats of the B.F.W. seaplane.

The main planes, which are of large span, are of the usual plan form, that is to say, rectangular with rounded corners. They are connected by three pairs of spruce struts on each side of the *fuselage*, and the upper main plane is attached, in the centre, to a steel tube *cabane* resting on the upper longitudinals of the body. The attachment of the struts to the spars is very reminiscent of that employed in the Albatros biplanes, and consists of a bell-shaped piece of steel, secured by means of a bolt passing down through the spar, as shown in the accompanying illustration. The bracing cables are attached to this bell-shaped steel piece by passing the lower end of the wire strainer, which is fitted with an anchor-piece as shown in the sketch, through openings in the sides of the bell. This fitting does not impress us as being such a good piece of work as that of the Albatros machines, in which, if we remember rightly, the strainers were attached to a ring resting inside the steel bell.

Another of our sketches shows the trolley used for transporting the machine short distances overland. The two wooden cross-members, it will be seen, are partly channelled out to receive the two transverse steel tubes



Sketch showing cable attachment to inter-plane struts.

of the chassis, and for starting off from a shallow beach all that is necessary is to run the machine out until sufficiently deep water has been reached, when the trolley will automatically be left behind, and the machine free to proceed on its floats.

The subject of another of our sketches is the tail float and planes. The stabilising plane is semi-circular, and to it are hinged the two elevator flaps. The rudder, which is partly balanced, is covered at the lower end with a copper skin to protect it against the action of sea water, and is used for steering on the water at low speeds. A small tail float of the form shown in the sketch takes the weight of the tail planes.

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Aerial Attacks on Steamers.

IT is reported from Washington that the United States Government has, through its Minister at the Hague, Mr. Van Dyke, sent a strong protest to Germany against the dropping of bombs near relief ships bound for Belgium.

The Norwegian steamer "Diana" reported having had a shower of darts dropped on her decks from a German aeroplane while lying in Calais Docks.

Another Air Raid on Calais.

THE following account of the bomb-dropping on Calais on Saturday was sent by the *Daily Mail* correspondent in the North of France:—

"The inhabitants of Calais were awakened this morning at probably an earlier hour than usual by a small shower of bombs and the booming of guns from the forts. A Taube managed to get right over Calais at a great height, before being observed and fired on, at six o'clock this morning. Before disappearing the pilot managed to drop seven bombs on the town. Three fell round the Central Station and one near the gas works. The damage done, however, was slight. Nobody was injured."

Air Raid Precautions in Germany.

A *Morning Post* correspondent at Amsterdam, writing on March 20th, said that he had had a conversation with a Dutchman recently returned from Germany, who said, among other things, that trains running through the Rhineland during night time have lights extinguished on approaching bridges as a precaution against aircraft attack.

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Prizes for Zeppelin Fighters.

A PRIZE of £1,000 has been offered by the *Matin* to the first aviator who compels a Zeppelin to descend within the zone of the fortress of Paris, and £400 to the gunner who may succeed in bringing down a Zeppelin.

German Aeroplanes in S.W. Africa.

REUTER'S correspondent at Garub (east of Luderitzbucht), reported the following on March 24th):—

"An enemy aeroplane made an attack at 7.30 this morning. It approached by way of the boreholes, which were, no doubt, the airman's objective, but was unable to get in any effective shots owing to the well-directed fire of our heavy guns."

This was supplemented three days later by the following message:—

"An enemy aeroplane again attacked our camp. It approached at sunrise flying extremely high, and after a wide detour northwards entered from the rear. The airman manœuvred as near as possible to our guns, and dropped a couple of shells and a few dart bombs or hand grenades. Only one native was slightly injured."

Invention and Aeronautics.

IN the report of the Comptroller of Patents, Designs and Trade Marks for the year 1914 it is noted that a marked falling-off was observed in the field of Aeronautics, in which invention has been very active during the last few years. Bombs and apparatus for their projection from aircraft claimed considerable attention from inventors.

The Royal Aero Club of the United Kingdom

OFFICIAL NOTICES TO MEMBERS

Aviators' Certificates.

THE following Aviators' Certificates have been granted :—

1126 Jean Claude Charles Marduel (French subject) (Caudron Biplane, Richmond, N.S.W.). Jan. 16th, 1915.

1127 Lieut. Gerald Allen (The Connaught Rangers) (Maurice Farman Biplane, Royal Flying Corps, Farnborough). March 11th, 1915.

1128 2nd Lieut. William Reid (Maurice Farman Biplane, Royal Flying Corps, Shoreham). March 16th, 1915.

1129 (Hydro-aeroplane) Flight Com. Henry Meyrick Cave-Browne-Cave, R.N.A.S. (Short Hydro-aeroplane, Royal Naval Air Station, Isle of Grain). March 20th, 1915.

THE FLYING SERVICES FUND.

Administered by The Royal Aero Club.

THE Lords Commissioners of the Admiralty and the Army Council having signified their approval, the Royal Aero Club has instituted and will administer a fund originated by M. André Michelin for the benefit of officers and men of the Royal Naval Air Service and the Royal Flying Corps who are incapacitated on active service, and for the widows and dependents of those who are killed.

The fund is intended for the benefit of all ranks, but especially for petty officers, non-commissioned officers and men.

In view of the great utility of the work of the Flying Services, evidence of which has been repeatedly given in the official despatches of the Commander-in-Chief, the skilful and daring flights into enemy country, and the protection afforded by the continuous patrolling of our coast by aircraft, it is confidently expected that the British public will welcome this opportunity of showing their appreciation by subscribing promptly and liberally to the fund.

The Right Hon. Lord Kinnaird has kindly consented to act as Honorary Treasurer to the Fund.

Subscriptions should be forwarded to The Flying Services Fund, The Royal Aero Club, 166, Piccadilly, London, W., or to Barclay and Co., Ltd., 1, Pall Mall East, London, S.W. Cheques should be crossed "Barclay and Co., Ltd."

TULLIBARDINE, Brig.-General,
Chairman of the Royal Aero Club.

	£	s.	d.
Total subscriptions received to March 24th, 1915... ...	7,720	8	5
Per "W."	0	8	6
W. H. Morrison ...	1	0	0
Miss C. I. Henderson	5	0	0
Miss Winifred Murton	0	1	0
Paula	0	5	0
Miss M. Cartwright ...	0	10	0
Venesta, Ltd.... ...	10	0	0
Alfred W. H. Peyton	1	0	0
Arthur S. Morrison ...	1	1	0
Miss Nettlefold ...	50	0	0
Lady Conan Doyle ...	2	2	0
Total, March 30th, 1915 ...	7,791	15	11

166, Piccadilly, W. B. STEVENSON, Assistant Secretary.

FROM THE BRITISH FLYING GROUNDS.

London Aerodrome, Collindale Avenue, Hendon.

Grahame-White School.—Wednesday, last week, Probationary Flight Sub-Lieuts. Mack, Hards and Jackson circuits, eights, &c., alone. Bone, Potts, Wain (new pupils), Feeney, Jacob, Kerby straights with Instructors Manton, Russell and Winter.

Friday, Probationary Flight Sub-Lieuts. Feeney, Greer and Jacob straights with Instructors Russell, Winter

Copyright, F. N. Birkett, from the F.N.B. Series of Aviators.

Flight Sub-Lieut. J. S. Morrison, Flight Sub-Lieut. W. H. Dunn. Flight Sub-Lieut. L. H. Irving.
Three new pilots who have qualified for their *brevets* at the Grahame-White School, Hendon.

and Manton. Probationary Flight Sub-Lieut. Hards solo circuits.

The other days too windy for school work.

Beatty School.—The following pupils received instruction during last week :—Messrs. Bond, Cornish, Roche, de Meza, Ormsby, Hayward, Faning, Forbes, Bright, Laver, Vickers, Cooper, Leong, Morgan, Allcock, Chapelle, Fraser, Whincup, Wainwright. The instructors were Messrs. G. W. Beatty, W. Roche-Kelly, and C. B. Prodger, the machines in use being Beatty-Wright dual control and single-seater. Mr. Bransby-Williams and Mr. Watson continued extra practice.

Hall School.—During last week the following pupils received instruction :—Messrs. A. Davy, Waterson, E. Mitchell, E. Cini and E. J. Furlong, doing a number of straights, and Lieut. Blythe flying half circuits. Machines in use being 35 h.p. tractor biplane, single-seater; 45 h.p. tractor biplane, two-seater; and a 35 h.p. tractor biplane two-seater machine.

Mr. J. Rose was the instructor for the week.

A 50 h.p. Gnome *fuselage* tractor biplane is now being finished off in the works, and will shortly be put into commission.

London and Provincial Aviation Co.—Monday and Tuesday last week, windy. Wednesday, W. T. Warren test flight, Monsieur Deschamps straights, E. C. England Derwin, straights. Thursday, windy. Friday, Lieut. Fairbairn, rolling. Saturday, windy.

Ruffy-Baumann School.—On Wednesday last week, E. Baumann on 60 Caudron with Mr. Bell for 10 mins. On 45 h.p. R.B., Mr. Roobaert and Hydon doing straights. Rolling on same machine. Mr. Bell (8 mins.), King (12), Jackson (8), Blandy (8).

Thursday, Mr. Sykes joined the school.

On Saturday the new machine arrived, and will soon be put into use for school work.

Instructors for the week E. Baumann and James Brothers.

Northern Aircraft Co., Ltd.

The Seaplane School, Windermere.—During last week tuition was given on Tuesday, Wednesday, Thursday, and Friday. Instructors: Messrs. W. Rowland Ding and C. L. Pashley. The following received instruction: Flight Lieut. Atherton, R.N. (42 mins.), Messrs. C. A. Barber (16), R. Buck (19), A. Johnson (26), F. H. M. Macintyre (20), J. Lankester Parker (23), G. L. Railton (6), H. P. Reid (34), J. F. Ridgeway (12), S. J. Sibley (12), H. Slingsby (38). Doing straights alone: S. J. Sibley. Extra practice: J. Lankester Parker. Machines in use: N.A.C. propeller biplane and Avro dual-control tractor biplane.

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FLYING ON ACTIVE SERVICE.

The following extracts from a letter by an officer at present serving with the Royal Flying Corps, which appeared in the *Daily Chronicle* of the 22nd ult. must be classed among the most convincing stories of work at the front, which have appeared :—

"Last month I certainly did have some very exciting experiences, and I will try and tell you something about them. One day when troops were being moved up we were sent out to patrol the lines and prevent German aeroplanes coming over. We met one coming over, and as soon as he saw us he turned and made for home in an almost straight line.

"The only reason he did not go in an absolutely straight line was that he wanted to lead us over the two anti-aircraft guns in this area. They shot at us, but they were afraid to aim in front, and their shells burst miles behind us.

"We chased him all the way back to his aerodrome, but, although we were a bit faster, we couldn't catch him, as he went down gradually, while we had to keep up. We saw another machine, but he went straight down too. We were so annoyed with these that we dropped two bombs, and then I fired about 50 rounds with the machine gun at them on the ground.

"Another day, when there was a strong west wind blowing, I had a near shave of not being able to get home. We knew the wind was about as strong as we could manage, and we hovered about a long time before we settled to go over. We went over a little way once and got back fairly easily. Then we went about ten miles over and turned round to get home. For nearly a quarter of an hour we made no headway at all.

"Then the pilot put the nose of the machine down, and we came down to 3,000 ft., and were able to make headway. But it would have been madness to go over the trenches at that height, making hardly any headway at all, so we climbed up again before we got to the trenches. Meanwhile, there was a big storm cloud, which I could see coming up from the west, and it was an exciting race. If we got into the cloud we should have to come down or else lose our way hopelessly, and probably be blown back ten miles in half as many minutes. So I had to sit and watch the storm coming up, and keep looking to see if we were making any headway.

"When we were almost virtually over the trenches a bullet came through the bottom of the machine, through my puttee and leather coat, and out through the top plane. Next moment the clouds swept down on us. The pilot went straight down and we roared through the cloud. I hadn't the slightest idea whether we were going straight or turning round (you never can tell in a thick cloud), but when we emerged at about 800 ft. we saw we were comfortably this side of the trenches, and we got home safely. We had only 10 minutes' petrol left, so we were lucky.

"It was a great success, as we were the only machine to get really over the lines that day. Next day we had to go over an area where we well knew there was a very good gun. We were particularly told to have a good look at this bit, so we had to go right over it. They soon began to shell us, and the concussion of the very first shot shook us and gave me quite a headache.

"They then got five or six very unpleasantly-close shots at us, and then one a few feet below us which fairly spluttered us all over with bullets and splinters. One bit of shell passed between the pilot's legs, through the petrol tank, and just grazed past my shoulder. The petrol was spilt all over the place, and half suffocated the pilot. The engine stopped, and we swung round to the right and down. We soon got out of range, and then the engine picked up. Luckily there was an auxiliary petrol tank, and we pointed for home as hard as we could go.

"Before we landed the pilot shouted to me to have a look over and see if the wheels were still there. A few days after this our engine stopped when we were right over Lille aerodrome, but it unaccountably started again. We could see the German machines on the ground below us. These were my chief experiences in February."

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Forthcoming Lectures.

It is announced by the Institution of Automobile Engineers that Mr. F. W. Lanchester is to read, on April 14th, a paper on the subject of the Screw Propeller, which will be complementary to the one on "The Aerofoil," read at the last meeting, and which is appearing in our columns.

Dr. R. T. Glazebrook, C.B., director of the National Physical Laboratory, is to deliver a lecture on "Aeronautics" before the North-East Coast Institution of Engineers and Shipbuilders, Newcastle-on-Tyne, on April 30th.

The Wilbur Wright Memorial Lecture is this year to be delivered by Prof. G. H. Bryan, Sc.D., F.R.S., and he has chosen for his subject "The Rigid Dynamics of Circling Flight (Steady Motion in a Circle—Lateral Steering of Aeroplanes)." It is to be given on May 20th.

U.S. NAVY ASKS FOR SEAPLANES.

"IF the American national bird cannot fly—what sort of a bird is it? Surely not an eagle." These words were written by Alan R. Hawley, President of the Aero Club of America, who, like the American aeronautical journals, has been voicing the urgent need for America to obtain a substantial addition to the ridiculously small sum of $800,000—$500,000 for the navy and $300,000 for the army—appropriated by Congress to aeronautics. It is hoped in American aeronautical circles that when the matter comes before the U.S. Senate a large increase over this amount will be granted. In the meantime the U.S. Navy is asking American aeroplane manufacturers for bids for seaplanes. The bids asked for fall into two classes, Bid A being for furnishing three seaplanes and four power plants, and Bid B for six seaplanes and eight power plants. Of the machines in the Bid A class one is to be delivered not later than April 15th, 1915, and the remainder not later than June 15th, 1915. The same dates apply to the seaplanes in Bid B class, except that here two machines must be delivered not later than April 15th, and the rest by June 15th. Bids in both divisions are required to be itemised under the following four headings :—

1. *Aeroplane*, including the aeroplane proper, with stabilizers, controls, control surfaces and leads, armour, launching truck, engine covers, and cockpit covers.

2. *Power plant*, including motor, propeller, radiator, petrol and oil tanks, piping, controls, petrol and oil gauges, wireless outfit, lighting outfit and power transmission system.

3. *Instruments*, including instrument board complete, compass indicator and drift indicator, light-weight sextant, chart holder and incidence indicator.

4. *Automatic stabilizers.* (If proposed.) Bids to be itemised.

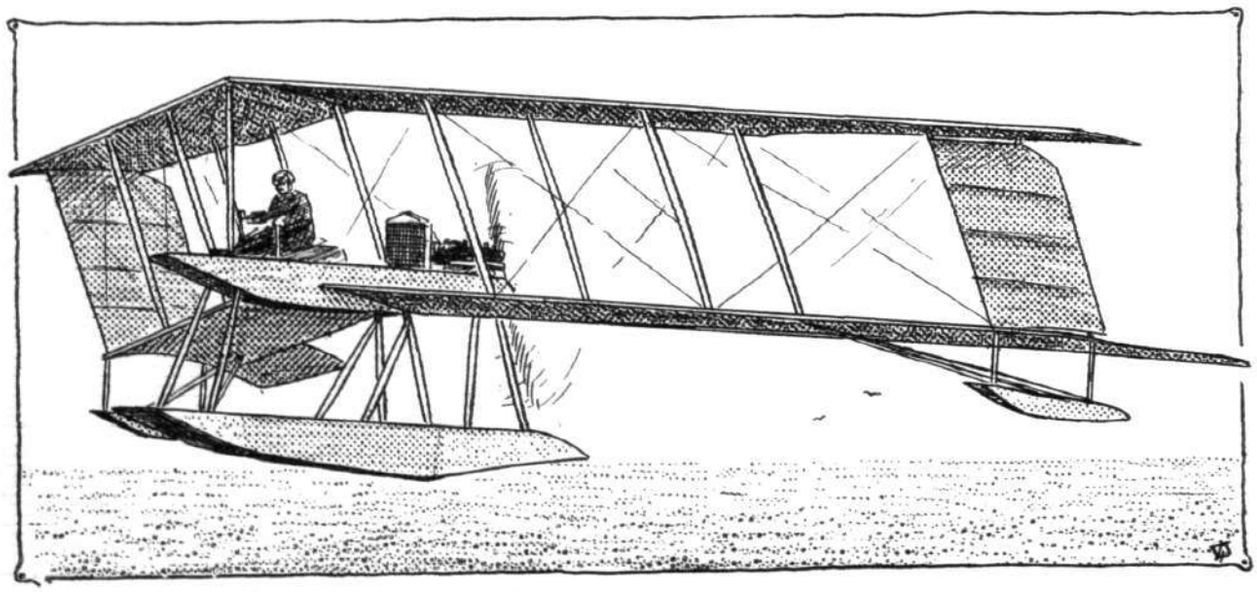
The decision as to merit of design will be based on the extent to which proposed designs conform to or exceed the requirements, and in this respect the following points are considered of importance in the order given: Speed, radius of action, climb, glide, and the extent to which refinement of detail is carried in the effort to reduce head resistance to a minimum.

By way of general requirements, the machines are to be two-seater seaplanes, with a speed range of from 50 to 80 miles an hour and a radius of action of at least four hours at full speed. The climbing capacity must be at least 250 ft. per minute for the first 10 minutes, and the gliding angle should be at least 6 in 1. It is a condition that Government inspectors shall have complete and free access to the shops, plans, specifications, and records of tests of materials involved in construction of machines.

All parts are to be protected from wet and salt-spray by the use of approved paints or varnishes, &c., or by the use of non-corrosive material, and portable covers for the cockpit and power plant must be furnished with the machine. The wing section should be one whose characteristics as regards efficiency and stability are known. The principal hull or hulls are to be subdivided into water-tight compartments, which must be provided with means of draining while afloat. The controls are to be capable of operation by either person, unassisted or in conjunction, and the pilot should be able to take charge from the other by force. All control cables are to be in duplicate, and the duplicate cables should, as far as practicable, follow different lines from those of the principal cables.

The main planes must be capable of being quickly removed or folded, and the machines shall be provided with a single eye above the upper plane as nearly over the centre of gravity as practical for hoisting aboard ship on the water. A transportation truck is to be provided with each machine.

As regards the power plant, the motor should be capable of being started from either seat, and the carburettor is to be provided with means for heating and with a successful means for muffling to prevent fire in case of backfire from the engine. Dual independent ignition and double magnetos must be fitted. The fuel tanks must have a capacity sufficient for at least four hours' flying at full power, and provision must be made to carry an additional amount of 200 lbs. of petrol. The fuel tanks are to stand an internal pressure of 5 lbs. per square inch, and must be divided by swashplate bulkhead.



ONE OF THE U.S.A. GOVERNMENT BURGESS-DUNNE SEAPLANES.—This machine is somewhat smaller and faster than its predecessors. It has a Curtiss OX 100 h.p. motor, and the planes, which are staggered, fold together when dismantled.

The service feed tank must have a capacity of at least one half hour's flight.

Before installation one motor is to be selected from each bidder, and put through the following complete set of tests, and the remaining motors belonging to the same contract will have to pass test D.

Test A, one half hour run on the test bench to determine the maximum brake horse power and the revolutions necessary to develop the rated horse power; to be followed by the calibration run for determining the b.h.p., r.p.m. curve.

Test B, motor and propeller to run for half an hour at full power while inclined upward at an angle of ten degrees.

Test C, motor and propeller to run one half hour at low speed while inclined at an angle of ten degrees downward. The low speed should not exceed 25 per cent. of the speed for full power.

Test D, four hours' run of the motor with calibrated moulinet at full power. After the four hours' run the motor shall be disassembled, and the motor and auxiliary parts shall be weighed. It will then be carefully examined and the conditions within noted, particular attention being paid to the amount of wear and of carbon deposit. If the above tests and inspections prove satisfactory, the motor will be reassembled and given an additional four hours' run without any adjustments or replacements during same.

The various weights allowed for outfit and equipment are as follows:—Machine gun and mounting, 30 lbs.; box of ammunition, 60 lbs.; instrument board, 20 lbs.; armour protection for engine and crew, 40 lbs.; for compass, drift indicator, sextant, chart holder, and incidence indicator is allowed 12 lbs.; emergency rations, including drinking water, 20 lbs.; tool kit, 10 lbs.; fire extinguisher, 8 lbs.; sea anchor and line, 6 lbs.; and first aid kit, 8 lbs.

Before being allowed to enter the acceptance trials, each machine must be flown by a representative of the manufacturer in order to demonstrate to the satisfaction of a Government inspector that it is capable of meeting the requirements.

If the weather affords an opportunity, the machine must ride at anchor or adrift in a 25-mile wind in open water for four hours without danger of capsizing. When adrift it should normally head into the wind. The machine must be capable of getting away with full load on board in a calm and on smooth water in a distance of not over 1,500 ft. (from a start with the engine throttled down to one-quarter of the full speed revolutions at the starting mark). It should also be capable of getting away and of alighting in a 25-mile wind in rough water in the open sea, and of landing at high speed before the wind without danger of nosing under. The hull should begin planing at or below 20 miles an hour in rough water, and have a sufficiently easy bow to allow of ploughing through a moderate sea without undue pounding or wetness.

As regards air-worthiness any machine proposed shall have initial or natural lateral, longitudinal, and directional stability in flight, such that moderate variations from the neutral attitude shall produce positive righting moments. Automatic stabilisers if used must be of demonstrated efficiency and reliability, and should be capable of being instantly thrown into or out of action as required. They should not interfere with the directional control of the machine.

The maximum and minimum speeds will be ascertained by not less than five runs over a measured course exceeding two miles in length. A glide of at least 1 in 6 is to be made in still air with the engine dead.

Before any machine is admitted to the acceptance trials the following data must be furnished by the manufacturers:—General arrangement drawings, motor particulars, wing section with characteristics, and stress diagrams (a) maximum, (b) minimum and (c) upside down.

EDDIES.

FOLLOWING on the news regarding Noel and Verrier given in "Eddies" last week comes another letter from the front with the information that Noel has just been appointed to the Russian Order of St. George, having been selected to represent Aviation in the 6th French Army. Congratulations, Noel, and to the time when we all see you back amongst us.

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That the great deeds in connection with aviation are not necessarily actual work in the air is evidenced by a recent episode in which the salvage of a French Avion was concerned. The pilot of the crippled machine was forced to abandon this between the French and German lines. Capitaine Bellenger having heard of its fate, he made for the French trenches to ascertain what chances there might be of retrieving it. Upon learning that the machine would, if repaired, still be serviceable, he decided to bring it in, if at all possible. In the twilight, therefore, he set out with a small party of mechanics, and managed to reach the lame duck. It was then found, however, that as the chassis had been damaged, the machine could not be wheeled, therefore carrying was the only way of shifting it. This was a task the nature of which may be realised when remembering that the party was a small one, and the distance from the German trenches very short. By carrying it short stretches at a time, and with the utmost care, as the least noise would have revealed their presence to the enemy, the French lines were at last reached after what must have seemed an eternity to the plucky ones who took part in it. They only got back just in time, for hardly were they safe within their own lines before illuminating rockets were sent up from the German trenches, throwing a brilliant light on the scene where a few moments previously the little procession had been toiling under their awkward burden.

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Almost with the same regularity, although generally at a different time of the year, as the discovery of the sea-serpent, comes the rumour that the balloon has been found in which the Swedish explorer Andrée left Spitzbergen in 1897, in an attempt to reach the North Pole by air. The latest report hails from the Swedish Legation at Petrograd, and is to the effect that remnants of a balloon, believed to be Andrée's, have been found at Yockquik, in Siberia. Until further proof is to hand it would be as well not to place too much reliance on this latest report.

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Owing to a clerical slip on the part of the Northern Aircraft Co., the initials of Mr. Pashley, who has now joined up as an instructor at the Windermere Flying

School, were erroneously given last week in "Eddies" as E. C. instead of C. L. Pashley. As the N.A.C. state in explanation of their error, one is so accustomed to speak of the two brothers as a collective noun, that the mistake is easily understandable, but at present it is Cecil Pashley who is at the seaplane school. If the school goes on expanding as it is now doing, however, it is quite likely that the two brothers will again be working together before many moons have passed.

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While on the subject of flying schools and their activity, mention may be made of the doings at some of the Hendon establishments. At the Grahame-White works several new school machines are leaving the stocks in spite of the call on the firm's time for Government work. A 50 h.p. biplane of the twin rudder type, similar to the machine on which Manton did such good flying in the old racing days, has been put into commission, and a larger biplane *sans* front elevator and with a two-seated *nacelle* was completed some little time since, and has, I believe, been up with 4 on board. This machine is fitted with an 80 h.p. Gnome.

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At the L. and P. school the new tractor biplane, with a 45 h.p. Anzani engine, is nearing completion, and should form a valuable addition to the two 35 h.p. biplanes already in use. In view of the continued expansion of this school, a further increase in the L. and P. "stable" is contemplated, but more of that at a later date.

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The Beatty contingent is busily at work on the new tractor biplane, the designs for which were got out recently. Whilst keenly awaiting the day when it shall be ready to take the air, the pupils, needless to say, are not twiddling their thumbs, a fact which anybody can easily corroborate for himself by the simple expedient of taking a trip to Hendon on any day when the wind is blowing something less than a gale. Some of the Wrights are sure to be up and doing; if it is a calm day the beginners will be hard at work, and should there be a wind blowing the more advanced are out for rough weather practice.

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At the Ruffy-Baumann school they were busy the other day erecting the new 60 h.p. dual-control tractor, to which I referred recently, that had just arrived from the works. Generally speaking the latest acquisition is similar to the two-seater now used by the pupils. In the centre the upper plane is cut away to give a better view upwards, a by no means unnecessary precaution having in mind the number of machines that are dodging about whenever the dispenser of winds is having a rest. If more school machines are forthcoming, the R.-B. school will have to look about for another shed, as the one now occupied has already four 'buses in it. In order to give a little breathing room the ever-ingenious Baumann has devised a sort of platform on to which one of the machines is "elevated" by means of a couple of planks. There is no truth in the rumour that Baumann at the end of the day's work flies the machine into the shed and pancakes it on to the platform.

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Some changes are imminent at the Hall sheds, where they are hard at work building *fuselages* for some of the school machines. The 'buses hitherto used are tractor biplanes of the Caudron type, and it is now intended to make the experiment of fitting a *fuselage* into the old type wings. It is expected that this combination will give a considerable increase in speed, as it will not only do away with a number of struts but also with the tail booms and skids. The chassis will be kept of the same width as before, so as to retain the unquestionably good landing qualities of the Caudron type, although the absence of the long skids running to the tail will probably increase the distance that the machine will run before getting to rest. The small tractor *fuselage* biplane built in France by the Caudron firm was probably one of the finest machines of its kind ever produced, and although lower-powered, there is no reason to doubt that the Hall machines will be any less successful.

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Hawker's visits to Hendon are assuming such regularity that one begins to look forward to them, as his flying is always a source of great enjoyment, On Saturday last the admiration was a rather long range one, as Hawker was flying for quite a long time several miles outside the aerodrome. Numerous guesses as to the cause of this circuitous course were ventured, ranging from the belief that Hawker had lost his way to the surmise that his engine had stopped and he was floating about unable to get down. When he finally landed, coming in over the sheds travelling at a tremendous pace and missing them by a few feet, it was learned that he had been completing the Admiralty one hour test.

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Of the other machines that took the air on Saturday mention may be made of the de H. 1, which, piloted by Mr. de Havilland himself, went through a series of evolutions, including steep climbs and heavily-banked right and left-hand turns. In spite of the strong wind blowing at the time, no difficulty was apparently experienced in handling the gun 'bus, and she finished her little jaunt in a short but sharp snowstorm. A short flight was also made by a Naval pilot on the 100 h.p. Dep. monoplane, on which in the piping times of peace Commander Porte did so much excellent work.

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With the Easter holidays the season opens at Hendon, where, given favourable weather, there will be exhibition flights, passenger trips, and probably racing on all four days. Quite like old times, in fact.

Now then, who said "stunts" at Hendon for Easter.

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Dropping off a 'bus (not one of the winged variety) at Cricklewood the other day I ran into Mr. Ramsay of the British Caudron Co., and accepted an invitation to have a look at some new Caudrons that are under construction at the firm's Cricklewood works. These machines, which are, I believe, of the G 3 type with small triangular fins in front of the rudders, are excellently made, and the new premises now occupied by the B. C. Co. allow of the machines being turned out at a good rate. A few alterations in design were noticeable, as, for instance, an increase in the span and a decrease in the gap, which conjointly help to give a very "racy" look to the machines. The usual blue colour that one associates with the Caudrons was effectually disguised by coatings of green and khaki in patches, a form of war-paint which should make the machine look, from above, like a cabbage patch. However, no amount of disharmony of colours is able to spoil the good flying qualities of the Caudrons although the difference in velocity of air currents ascending from the various hues might quite conceivably form all sorts of *remous*.

"ÆOLUS."

FLIGHT

THE FLYING MACHINE: THE AEROFOIL IN THE LIGHT OF THEORY AND EXPERIMENT.

By F. W. LANCHESTER, M.Inst.C.E.

(*Concluded from page 217*).

§ 11. *Quantitative Theoretical Treatment* — continued. *An Example.*—Let us be quite clear as to the position : we have Fig. 17, an aerofoil of span l, and of any aspect ratio we wish within reason dealing with a mass of air represented by the volume swept by a circle (shown dotted in the figure), of a diameter equal to the span. This is the equivalent mass of air to which downward velocity is continuously imparted, representing a quantity of momentum per second corresponding to (in absolute units equal to) the load sustained. We can make our knowledge at the present juncture the basis of exact calculation, and we may take for example the case of the aerofoil R.A.F. 6, of which tests have been made by the National Physical Laboratory. (Adv. Committee for Aeronautics, *1912–13, Report No. 72.*)

Since we have so far made no provision in the present exposition for correlating the angle of attack with the motions of the air, we shall deal only with the *drift/lift* ratio as a function

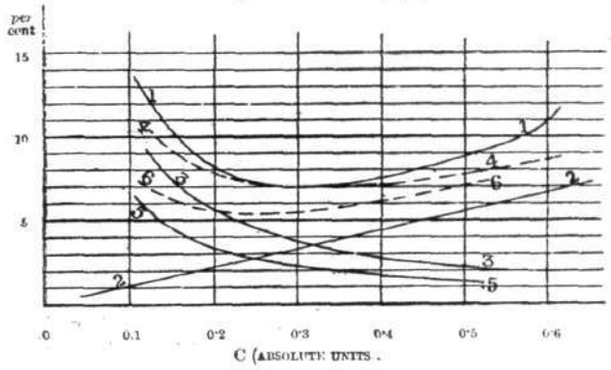


Fig. 18.

of the *absolute lift coefficient*, the former being plotted in Fig. 18 as ordinates and the latter as abscissae. In Fig. 18, curve No. 1 is plotted from the same data as Fig. 8 of Report 72, to which reference has already been given; the determinations relate to a model of the aerofoil known as "R.A.F. 6" about 1/30th full size, namely, 15 in. by 2·5 in., aspect ratio = 6. The velocity is given as 30 ft./sec. Curve No. 2 is the calculated *drift/lift* as due to aerodynamic expenditure of work on basis of circular column of air diameter $= l$ in accordance with the present hypothesis. Curve No. 3 is the *drift/lift* as due to the skin-frictional or direct resistance of the aerofoil, based on a coefficient $\xi = 0{\cdot}017$ computed in the manner laid down in the author's James Forrest Lecture, 1914, Appendix I. Curve No. 4 is the sum of curves Nos. 2 and 3, and purports to represent on our present basis of theory the total *drift/lift* as given by curve No. 1 from direct experiment.

It will be observed that the agreement between curves Nos. 1 and 4 is only exact in the immediate vicinity of minimum value; incidentally it may be remarked that this is the most important portion of the curve. The reason for the want of agreement at other points in the two curves is undoubtedly due to the fact that the camber of the model used in the experiments was particularly adapted to work with a lift coefficient (absolute units) round about 0·3, and when employed at greater coefficients (corresponding to steeper angles) its camber would be evidently insufficient and the resistance would be augmented by eddy making, when, on the other hand, the lift coefficient is lower the camber is too great and eddies again arise, resulting in increased resistance. In order to obtain a curve experimentally to agree with No. 4 the camber and angle ought to be varied in sympathy; that is to say, as the lift coefficient is increased both angle and camber should be increased *pro ratâ*. The arithmetic in connection with the plottings in Fig. 18 is given in Appendix IV. Curves Nos. 5 and 6 are based on a lower coefficient of skin-friction ($\xi = 0{\cdot}0105$) as appropriate to the full-sized machine at 100 ft./secs. flight velocity: although of not immediate bearing on the discussion, the author deemed that they might be considered of interest.

§ 12. *Quantitative Theoretical Treatment*—continued. *The Angle of Dip.*—We have already seen that the angle of dip α Fig. 13) is the factor which determines (in conjunction with the angle θ) the angle of trail β, and thus also the theoretical camber of the aerofoil. It remains to be demonstrated how the angle α may be deduced or computed from our knowledge of the peripteral system.

We will take the most rudimentary system as a starting point. In Fig. 19 we have the aerofoil span $= l$, and aspect ratio $= n$, generating a simple vortex pair about its extremities x, x'; then the cyclic notion around the aerofoil is of the same strength as that in the trailing vortices. Now confining ourselves to the middle section of the aerofoil, in the line of flight, we presume to

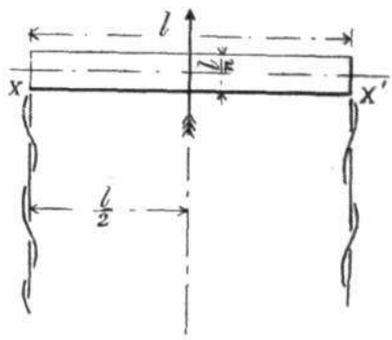


Fig. 19.

know the angle θ (Fig. 13) as given by our main calculation for sustentation, hence $V \tan \theta$ is the combined velocity of the two trailing vortices at a distance $l/2$ from the vortex foci. But the velocity of the cyclic component varies inversely as its distance from the focus; and for the single vortex the velocity at $l/2$ is $V \tan \theta/2$, or at a distance of half the chord the velocity is $nV \tan \theta/2$ which is the value of $V \tan \alpha$ required; or $\tan \alpha = (n+2) \tan \theta$.

On this basis the constant ϵ of the author's "Aerodynamics" becomes (assuming always the hypothesis of the *small angle*) $n \div (n+2)$, a result which is of the right order but some 15 per cent. to 25 per cent. too high. We know, however, that the system, consisting as it does of a single vortex pair, is in reality impossible; we will now apply the same method to the case of distributed vortex motion already considered, as generated by the impulse system of Fig. 16. Without going fully into detail, it may be pointed out that the equivalent base of the trailing vortices is now very much less than the span of the aerofoil, the actual relation is 0·78, or the velocity $V \tan \theta$ corresponds to a distance from the equivalent vortex centre $= 0{\cdot}39\ l$, or, working as before for the single vortex at distance equal half the chord, we have $0{\cdot}39\ nV \tan \theta = V \tan \alpha$, or $\tan \alpha = 0{\cdot}39\ n \tan \theta$.

On this basis the constant $\epsilon = n \div (n + 2{\cdot}56)$. The resulting values are now within 10 per cent. of those given in the table.

In the case in point, taking the condition of least resistance of Fig. 18, the angle θ works out as 0·07 (radian) and since $n = 6$ we have

$$\alpha = 0{\cdot}39 \times 6 \times 0{\cdot}07 = 0{\cdot}165$$
$$\text{and } \beta = 0{\cdot}07 + 0{\cdot}165 = 0{\cdot}235$$

these values being represented by a surface of simple arc section in Fig. 20.

Fig. 20.

The above defines the theoretical camber for the mid-section of the aerofoil, but under the conditions assumed this will not be constant; θ is constant, this being the basis on which we are working, but the added camber required to deal with the cyclic component will depend upon the local strength of the vortex, which varies from point to point. The distribution is actually that of the velocity potential field of Fig. 16, and from this it appears that the correct *grading* for the addendum camber as represented by the angle α will be proportional to the ordinates of a semi-circle whose base is the span of the aerofoil.

§ 13. *Conclusion.*—It has not been found possible in the present paper to do more than give an outline of the theory of sustentation, with sufficient examples and references to practice and experiment, to illustrate the importance of the theoretical aspect of the subject as bearing on the experimental treatment; the latter has hitherto been

dealt with almost without regard to considerations of theory, and has degenerated into empiricism pure and simple. For example, mouldings are made to "stock sections" and cut off to different lengths to determine the effect of change of aspect ratio; or again, aerofoils of some definite camber are tested under unfair conditions, *i.e.*, those to which their particular camber is ill adapted, and inferences are drawn as to best values of pressure constant, &c., which are in no sense justified. The attempt is obviously that one condition only shall be changed at a time, but owing to lack of consideration the result is exactly the contrary.

We are acquainted with many parallels in engineering practice. If one wishes to find the speed of maximum torque of an internal combustion engine, for example, to religiously change the one condition of speed would be, of course, absurd; the ignition timing must follow the speed, and the carburettor may need several trial adjustments. Scores of similar examples could be quoted.

The latter portion of the paper dealing with the quantitative treatment on vortex theory only purports to be a sketch of a very promising development, and may be taken as an indication merely of the lines on which the author is at present at work. So far, the cases taken are those for which the main material for solution happens to be at hand; it must not be imagined that the examples of vortex motion utilised have been selected for any other reason, also the results have in some cases been given without the whole of the reasoning or proofs on which they rest. Before the method can be considered complete, we require to possess the means of specifying our vortex distribution at will, and of solving the same to give the primary and second camber for all points along the span of the aerofoil; the author is at present engaged in endeavouring to find a practical solution to this general problem in such manner as will give the designer full control over his product—the difficulties do not appear to be insurmountable.

APPENDIX I.

This appendix will comprise a reprint of a note communicated by the author to the Advisory Committee for Aeronautics (May, 1914) concerning the influence of the "wash" of the aerofoil on the tail member of a flying machine as affecting stability. In this communication it is demonstrated that experiments made at the National Physical Laboratory to detect and measure this effect give results in close agreement with the author's theoretical method of treatment as based on vortex theory as given in his "Aerial Flight," Vol. II, pp. 99 *et seq.*

APPENDIX II.

The form of the degeneration of vortex rings and vortices generally is a matter of considerable interest. The author has observed that the degeneration is always accompanied by an access of fluid to the inner system of flow, the additional fluid entering the inner system in the vicinity of the axial line *from behind.* Thus, the theoretical shape of the surface of separation in an ordinary two-dimensional vortex pair is that given in Fig. 21 (A), the fluid in the inner system remains intact and unchanged to perpetuity. In actuality it appears that the flow takes place as in Fig. 21 (B), a layer of fluid from the outer system after passing on either side of the combined vortex instead of passing away symmetrically, in other words, returning to its original condition, is actually caught by the vortex and enters it from the rear, becoming in due course the outermost layer of the inner system.

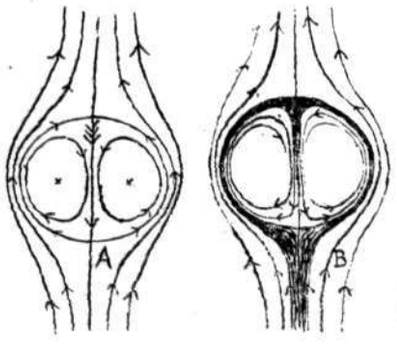


Fig. 21.

The broad meaning of this, and, in fact, the proof of its *necessity*, is in reality very clear and simple. The impulse of the vortex is represented permanently in its momentum, and this is a quantity which does not undergo diminution. The energy of the vortex, on the other hand, is being slowly eaten up internally owing to the fluid being imperfect, *i.e.*, by the direct and indirect efforts of viscosity. Now, if a dynamic system loses energy under the condition of momentum = constant, there must either be a redistribution of the momentum between the different portions of the system tending to a state of uniform motion, or the system must acquire additional mass, for, momentum mv = const. = k

and energy = $mv^2/2 = k^2/2m$.

That is to say, mass must vary inversely as energy, hence as the energy of the vortex is dissipated, addition to the mass is necessary. The alternative, that the velocity of the different portions of the vortex system tends to equalisation, may be, in some degree, also true, especially as due to a gradual increase in the diameter of the rotational core or cores, but there is obviously a limit to the extent to which this can take place. The increase of mass is clearly essential and the rate of increase would probably serve as a very close measure of the energy dissipated could measurements be made.

The bearing of this on the problem of flight is that we are led to regard the trailing vortices almost as permanent; the distance separating their axes becomes greater and greater the "older" they become and the further their energy is dissipated, but the form of motion remains intact in all probability miles astern of a machine in flight.

APPENDIX III.

In considering the lateral force due to a cyclic system superposed on a motion of translation, the simplest conception to adopt is that the cyclic motion is due to an impulse applied in a direction at right angles to the translation; in the case of the aerofoil we imagine it to be applied to the surface represented by the track of the advancing foil, that is to say, to a horizontal plane surface extending from the after edge of the foil indefinitely rearward: the direction of the impulse is of course downward. Now this impulse represents a certain quantity of momentum M per unit area of the surface over which it is applied, and if the aerofoil advance through the fluid by one unit distance the *impulse surface* is extended by like amount, and for every unit span a quantity of momentum = M must be communicated to the air, hence the load sustained will be equal to the *velocity of flight* × *span* × M. This applies directly to the rudimentary case depicted in Fig. 19; when the vortex motion based on a distributed or multiple core (as is in practice invariably the case) the intensity of the impulse will vary over the length of the span in accordance with the distribution of the lines of *velocity potential* at the surface of gyration, and the form of the distribution requires integration to give the corresponding solution.

In order to carry out the author's present method (whatever the vortex system may be) two conjugate functions must be known; firstly, the distribution of the *stream function* (the ψ of the mathematician) over the surface of gyration on either hand of the axis of flight, as being the determining factor in the primary camber of the foil. Secondly, the velocity potential (the ϕ of the mathematician) as similarly distributed as determining the distribution of the momentum, and so also the secondary camber.

APPENDIX IV.

m_f = equivalent mass of air *per second*; v = velocity of downward discharge; V = velocity of flight; A = area of foil; n = aspect ratio; ρ = density of air; C = pressure constant (or lift coefficient) such that lift = $CA\rho V^2$ (absolute units); C_{90} = pressure constant for normal plane, say = 0·65; ξ = coefficient of skin friction (double surface augmented coefficient in this case); x-Drift = direct aerofoil resistance; y-Drift = aerodynamic resistance.

Lift (= weight sustained) = $m_f \times v$.

Energy $_f = m_f v^2/2$ $\quad\therefore$ y-Drift = $m_f v^2/2V$

$$\therefore \quad \frac{y\text{-Drift}}{\text{Lift}} = \frac{v}{2V} \qquad (1)$$

Now, on basis of § 11 (Fig. 17),

$m_f = \pi A n \rho V/4$, and lift = $CA\rho V^2 = m_f v$

$= \pi A n \rho V v/4$, or $CV = \pi n v/4$, or $v = 4CV/\pi n$.

Hence (1) becomes $\dfrac{y\text{-Drift}}{\text{Lift}} = \dfrac{2C}{\pi n}$ (2)

Where (as in R.A.F. 6) n = 6, this becomes $C/3\pi = 0{\cdot}106\ C$ (as plotted No. 2).

Again, x-Drift = $\xi C_{90} A \rho V^2$

and Lift (as before) = $CA\rho V^2$.

$$\therefore \quad \frac{x\text{-Drift}}{\text{Lift}} = \frac{\xi C_{90}}{C} \text{ or } \frac{0{\cdot}65\xi}{C}.$$

For model (chord = $2\frac{1}{2}$ in.) V = 30 ft./sec.

$\xi = 0{\cdot}017$.*

$$\frac{x\text{-Drift}}{\text{Lift}} = \frac{0{\cdot}017 \times 0{\cdot}65}{C} = 0{\cdot}011/C \text{ (as plotted No. 3).}$$

For full size machine,

$\xi = 0{\cdot}0105$.*

$$\frac{x\text{-Drift}}{\text{Lift}} = \frac{0{\cdot}0105 \times 0{\cdot}65}{C} = 0{\cdot}0068/C \text{ (as plotted No. 5).}$$

Condition of Least Resistance is x-Drift = y-Drift, or

$$\frac{\xi C_{90}}{C} = \frac{2C}{\pi n} \text{ or } C^2 = 0{\cdot}5\pi\xi n C_{90}.$$

Since $0{\cdot}5\pi C_{90}$, ordinarily speaking, lies within 2 or 3 per cent. of unity, we have approximately—

$$C = \sqrt{\xi n}.$$

* Compare James Forrest Lecture, Inst.C.E. 1914, Appendix I.

FLIGHT

A NEW BRITISH DOPE.

FREE OF TETRACHLORETHANE AND ALL HEAVY SPIRITS.

IN view of the strenuous conditions to which aircraft is being subjected during the present war, being frequently left out in the open for long periods at a time without any protective covering being available, the question of a good dope assumes even greater importance than is the case in time of peace. It is therefore not surprising that enterprising firms should turn their attention to the manufacture of dopes which would fulfil the military requirements for a non-inflammable, petrol and oil-resisting composition for the fabric covering of wings and *fuselage*. As we mentioned last week, among the newcomers into this industry are the British Aeroplane Varnish Co., Ltd., whose head office is at Milburn House, Newcastle-on-Tyne, and whose London office is at 57, Fenchurch Street, E.C. This firm are now marketing a new dope which will be known under the name Titanine. This dope was originally manufactured by Messrs. Holzapfels, Ltd., of Newcastle, at their Felling works, where they have for a very great number of years been carrying on business as manufacturers of anti-corrosive paints and varnishes for marine purposes, a line in which they are in all probability one of the largest firms in existence. Messrs. Holzapfels, Ltd., have now transferred their interests in the new dope to the British Aeroplane Varnish Co., Ltd., of which, however, Mr. T. W. Holzapfel is the Managing Director, and which will still be manufactured at the works at Felling-on-Tyne.

The chief advantage claimed for Titanine is that neither tetrachlorether, or any spirit derivative of chlorine, nor amyl acetate is employed in its composition. The recent cases of poisoning to workmen applying the dope were attributed to the use of tetrachlorether in dope. If for no other reason, this claim that the new dope contains no ingredients having any ill effects on the workers, should in itself be sufficient reason for giving Titanine a trial, as thereby, according to the manufacturers, the ordinary system of ventilation found in workshops will suffice.

In addition to its non-poisonous qualities, Titanine is claimed to conform to the R.A.F. specification, and from an examination of various samples of this dope it certainly seems to possess a remarkable degree of flexibility. It also sinks into the pores of the fabric as well as the majority of other dopes, and its contractility is stated to be about the usual, so that manufacturers who intend to give it a trial can attach the fabric at the ordinary tightness, knowing that after treatment the dope will tighten it up to the desired degree. It is almost superfluous to say that Titanine is petrol- and oil-resisting, and we are assured that it will also withstand the action of sea-water for long periods. Our representative witnessed a demonstration of its non-inflammability, a burning wax vesta being laid on a sample of fabric treated with Titanine, the only result being the charring of the fabric around the match. As to the effect that the air will have on this dope after long exposure, this is a matter which will have to be proved by the test of time under actual service conditions, although from samples of ten months old submitted to us there is no reason to doubt the manufacturers' confidence in this direction. The new dope, we might add, is furnished in one grade only, which is used for every fresh coating.

AIRCRAFT AND THE WAR.

Writing to the *Daily Telegraph* regarding the Suez Canal Campaign on March 15th, Mr. W. J. Massey said :—

"When, after the stubborn fight on February 3rd, the main body of the enemy retired towards the line of hills which form the eastern horizon, there were still several hundred Turks dug in about the hummocks and scrub near the Canal bank opposite Toussoun. They were sniping all night, and, for all the defenders knew, they might be holding the ground for a fresh bridging attempt to be made before dawn. The pontoons on the bank had been riddled with shell and rifle fire, but aerial reconnaissance had disclosed other pontoons with the main body, a couple of miles from the Canal."

Writing to the *Daily Telegraph* from Bale on the 22nd ult., Mr. A. Beaumont said :—

"The operations on the Alsatian side are becoming more serious every day. For the last three days the intensity of the artillery fire on both sides has been on the crescendo scale, and last night a number of balloons and aeroplanes joined in the general fray. . . . .

"Whilst the cannonade was at its height yesterday afternoon, a thrilling aerial fight was witnessed, the result of which remained in doubt. Three or four French aeroplanes had come over the Sundgau, and were reconnoitring, when half a dozen German machines suddenly appeared from the other side of the Rhine. They flew over the snow-capped peaks of the mountains of the Black Forest, and headed at full speed for the French aeroplanes. Both aerial squadrons met at a height of at least 6,000 ft. over the Rhine, and their evolutions were followed with intense interest by thousands of spectators on both sides of the frontier. The French, though less numerous, pluckily dashed hither and thither, circling about gracefully, and escaping the attacks of their enemies. Finally, they retreated over the Sundgau in the direction of Belfort, still pursued by the German aviators, none of whom had returned by dusk."

The following further particulars were given in a despatch sent on the following day :—

"The aerial battle of last Sunday which is mentioned in yesterday's message, was, according to German reports now to hand, even more important than we could have imagined on this side of the border. It appears that full twenty aeroplanes were engaged on both sides, and that it is considered to have been the greatest aerial fight since the beginning of the war. It took place in the triangle comprised between the Swiss frontier point at Lörrach and Mülhausen and Altkirch. The French aerial squadron came from the Vosges, and probably some also from the fortress of Belfort, whilst the Germans met them coming from the mountains of the Black Forest. The fortress of Istein opened fire on the advancing French squadron, and soon the batteries of Altkirch joined in, whilst from the aeroplanes themselves little puffs of white smoke darted out, showing that high up in the air the plucky aviators were defending themselves with machine guns and rifles. They circled round each other, watching every movement, and ready to dash one another to death like huge birds of prey. They finally disappeared in the direction of Altkirch, whilst long afterwards the pounding of the batteries could still be heard. One of the aviators succeeded in making a dash over Freiburg, where he dropped some bombs. Another reached Müllheim, and dropped several bombs between the barracks and the Lutheran church. The bomb, it appears, caused some casualties among the soldiers. Two more French aviators appeared over the same town, and the batteries of the Schlossberg and the Loretto heights opened fire on all three. It was reported that one of the French aviators was finally disabled, and that he landed, and was taken prisoner near Colmar. But the German version of the aerial fight does not mention this fact, which it would surely have done were it true, so that it may be taken for granted that it was a false report. All the French aviators probably returned safely to their quarters.

"Last night four French aviators again appeared over St. Ludwig, and flew up the Rhine valley in the direction of Mülhausen without being overtaken by the German planes. At Mülhausen, moreover, it is said that the whole station is occupied by troops and trains full of soldiers, waiting to be transported at the first sign of alarm to any of the critical points on the Vosges. I proceeded to one of the summits on the frontier yesterday, where one has a view of twenty-five miles and more, but no such great movement of troops could be

seen as had been announced. The heavy guns on both sides had fired away very actively during the early part of the day, but during the afternoon they fired only three or four shots a minute, and the anticipated big battle failed to come off."

According to a message from Amsterdam, bombs were dropped from on aeroplane on the Zeppelin shed at Berchem St. Agatha, near Brussels, on the 25th ult., and destroyed it.

Writing from Petrograd on March 26th, a *Morning Post* correspondent said :—

"The bright clear sunny days lately prevailing on the German front have been freely utilised by both sides for aeroplane enterprise."

A *Daily Telegraph* correspondent at Petrograd, writing on the 26th ult., said :—

"The low-lying ground between Mishinetz and Kolno has for the present been transformed into one huge unbroken lake, and the Russian aviators, who have been very active of late, have discovered that at certain other points in the German rear the roads are deep in mire. . . . . The enemy has also been busy in the air, and fourteen bombs have been thrown into Lomza from aeroplanes. They did no harm to the troops, but wounded nine civilians and killed a horse."

Mr. Percival Phillips, writing to the *Daily Express* from the Belgian frontier on March 26th, said :—

"The repeated air raids on Western Flanders are greatly contributing towards weakening the morale of the new troops lying in reserve in the villages behind the Ypres and Dixmude trenches. One attack at Staden tore up the railway junction, stopping the traffic with Roulers and delaying the shipment of ammunition for howitzers. Near Houlthust Forest one bomb exploded on a goods depôt, which had just been occupied by infantry fresh from the trenches at Knipehoek, and injured several, with the result that the depôt was evacuated. The last raid on Ostend set fire to a building near the Yacht Club containing naval stores, and our airmen have also bombed a supply train on the Bruges-Thourout road. Every day the Allies' aerial scouts are thick above the enemy's positions from dawn till dusk, with the regularity and unconcern of motorists in times of peace. Their work is of especial value in defining the German artillery positions on the Yser, and thus enabling the Belgian guns to shell them with great accuracy. This was especially the case on Wednesday, when the Belgians took two trenches."

A *Daily Telegraph* correspondent, writing from Tenedos on the 26th ult., said :—

"Early this morning, taking advantage of the return of the good weather, I sailed out to the Fleet. While I was there a German aeroplane, coming from the direction of Gallipoli, circled round the Fleet for a quarter of an hour, and then headed back and disappeared. It was of the Albatros type, and kept to a height of over 2,000 ft."

A *Morning Post* correspondent at Athens on the 27th ult., said that a telegram received on the previous evening from Rediadis, Tenedos, stated :—

"To-day the equinoctial gale subsided, and about noon two British seaplanes flew over the Straits to reconnoitre, while minesweepers worked busily all day clearing the section before Dardanus. . . .

"The Germans who are conducting the defence have organised mobile batteries of heavy ordnance, and the positions of these are constantly being changed, so that it is difficult for the ships to get the range. A large number of heavy guns have also been placed in positions so well disguised that it is sometimes difficult for the aviators to locate them. . . .

"All indications point to a speedy resumption of offensive operations in the Gulf of Smyrna. Yesterday a seaplane, starting from near Mitylene, flew over Smyrna."

Mr. G. Ward Price, writing to the *Daily Mail* from Tenedos on Saturday, said :—

"The only sign during the last twenty-four hours of all the formidable preparations for defence with which those brown and barren shores opposite are covered has been a solitary aeroplane 4,000 or 5,000 ft. up in the blue sky, which came from beyond Sedd-ul-Bahr, circled inquisitively over Tenedos, and sailed back again out of sight. It was no doubt some German air scout counting the ships that are waiting to renew the bombardment of the Dardanelles, and reconnoitring to discover any new dispositions for the attack. Meanwhile a day and night patrol at the entrance to the Straits goes on, and the fleet lies at different anchorages ready to go in again to its dangerous work."

In the German official *communique* issued on Saturday, there was the following :—

"French airmen bombarded Bapaume and Strassburg, in Alsace, without doing any military damage. In Bapaume one Frenchman was killed and two wounded. An enemy airman was forced to descend north-west of Arras. We dropped some bombs on Calais."

The following details regarding an air attack on Strassburg were given in the *Koelnische Zeitung* of the 27th ult. :—

"A hostile airman, keeping at a considerable height, approached the town and fortress of Strassburg from the direction of Schlettstadt, at half-past five on Thursday afternoon. From the type of machine the airman was apparently British. Machine-guns and guns opened fire from all the ramparts of the forts, but were unable to hit the airman, who at that time was flying at an altitude of 2,000 metres (over 6,000 feet). After hovering for 20 minutes above the fortress, the airman disappeared in the direction of the Breusch valley, after dropping five bombs on the south-eastern part of the town, but without doing any particular material damage."

A Berlin correspondent of the Danish *National Tidende*, writing on Saturday, said :—

"The aerial raid on Strassburg on Friday was effected not by French but by British airmen. A violent gunfire was opened on the airmen, but they were flying at an altitude of over 2,000 yards and were unhurt. The aeroplane was visible over Strassburg for nearly half an hour, and dropped five bombs. It is further admitted that during the night of Thursday-Friday aeroplanes destroyed the German hangars at Berghem, near Brussels."

An *Evening News* correspondent at Rotterdam sent the following story on Sunday :—

"My Antwerp correspondent reports that the success of the Allied air raid last Wednesday was due to the clever ruse of an Englishman who flew a German Taube machine. Two aeroplanes first served as a target for the German guns, then a Taube appeared on the scene, apparently to attempt an attack on the other two, which, however, escaped. The Taube landed on the sands on the left bank of the Scheldt, just opposite the naval works at Hoboken, where it was cheered by German soldiers who had seen the chase. Suddenly the Taube rose again and flew over a shed at Cockerill's shipyard and dropped several bombs on two submarines, one of which was ready to be launched and the other nearing completion. The pilot went off suddenly, and, rising, waved the British flag. Some Germans were killed or wounded. Thirty guns have now been sent for the protection of the shipyard, and the streets round about have been closed."

A Central News message from Tenedos on Sunday stated that aerial reconnaissances from the British parent ship "Ark Royal" are of daily occurrence.

The following extract is from a letter, from a naval officer present in the Dardanelles, which was published in the *Times* of 29th ult. :—

"A seaplane had gone inland to reconnoitre, and was returning over Yeni-Shehr at a height of about 2,000 ft., when, just as it passed over the windmills, some hundred or so, or possibly more, Turkish soldiers, who were hiding in or behind the windmills, fired a volley at it. Before you had time to say 'By Jove' there was a deafening crash, and when the smoke had cleared away those windmills—had been removed! It was an extraordinary sight. That little cruiser had sighted and hit and had completely wiped out those Turks almost before they had had time to see the result of their shots at the seaplane."

According to information received in Amsterdam from Vienna on Monday, Capt. Lehmann has been received in private audience by the Austrian Emperor. Capt. Lehmann, who, with Lieut. Stanger, was the last person to leave Przemysl by aeroplane, presented a report to the Emperor.

A *Morning Post* correspondent at Amsterdam, writing on Monday, said :—

"Two Zeppelin airships passed north of the Island of Schiermonnikoog this afternoon, going in a westerly direction. The Zeppelin shed near Berchem, respecting which I telegraphed yesterday, was destroyed by the well known Belgian airman Jan Olieslagers."

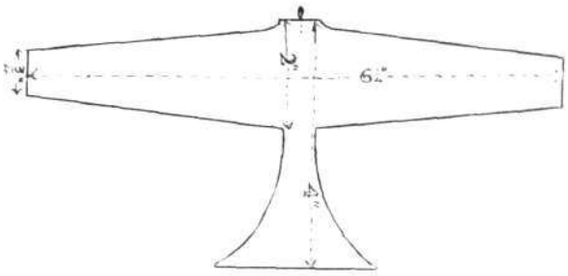
Models

Edited by V. E. JOHNSON, M.A.

Some Observations on the Lateral and Longitudinal Stability of Paper Gliders. By E. STEER.

PART I.—*Wing Curvature.*

THE gliders used are shown in the following sketch, with dimensions:—



Seven gliders of the type and dimensions shown above were made, each one having a special form of wing curvature. They were all subjected to the following tests: 1. Launched on an even keel; 2. Held by one wing tip with wings vertical, and dropped (to determine lateral stability); 3. Held nose downwards, and dropped (to determine longitudinal stability).

Glider No. 1.—The wings were given a very pronounced upward dihedral angle (Fig. 1.) In test 1 this model glided well, oscillated slightly, and then gradually steered a course to the left. When subjected to No. 2 test, it regained an even keel and performed a nose-dive, but flattened out when near the ground, showing a fairly good lateral stability. In test 3 the model made a perfect glide to the ground, showing good longitudinal stability.

Glider No. 2.—This glider (shown in Fig. 2) had a slight downward dihedral angle. In test 1 it made a fairly good glide. The lateral stability was bad, for when held by the wing tip and dropped, it struck the ground on the very edge of the wing tip. In test three the longitudinal stability was very good, and the model glided perfectly to the ground.

Glider No. 3.—The wings were given an upward dihedral angle and the tail a downward trend (Fig. 3). It passed test 1 fairly well, but slight oscillations were noticeable. The lateral stability was not very good, but the longitudinal was. The model had a tendency, when launched on an even keel, to head to the left.

Glider No. 4.—An ordinary flat glider (Fig. 4) was then tested. During test 1 it headed up wind, then turned downwards and rocked from side to side before gliding. Test 2. It oscillated violently and struck the ground so forcibly that it completely overturned. The longitudinal stability was fair.

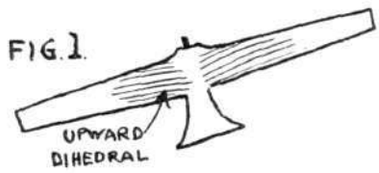
Glider No. 5.—In this model the wing tips were turned in at an angle of about 45° from the main plane. It was a bad jerky glider. It recovered slowly when subjected to test 2; the longitudinal stability was good.

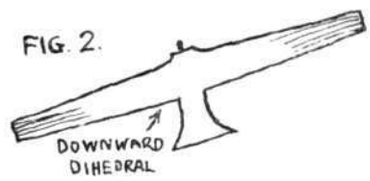
Glider No. 6.—No dihedral angle but a slight negative angle at the wing tips. Result, longitudinal stability good. A fair glider. Lateral stability not very good.

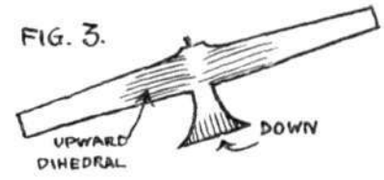
Glider No. 7.—This glider had a dihedral angle, and was curved at the wing tips to the extent shown in Fig. 7. It was an excellent glider, with no signs of oscillations. The longitudinal stability was good, and also the lateral. It was the most stable glider of the whole series.

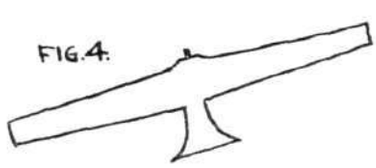
Several other types were tried, but were not sufficiently efficient to be worth describing. Models 1, 6 and 7 were the best with respect to stability. No. 1 has a drawback in the fact that it dives in the lateral stability test.

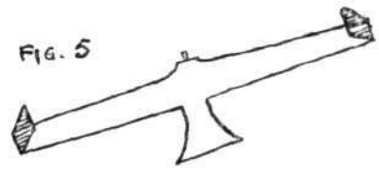
No. 6 is a decided improvement on glider No. 1, and should be worthy of trial on a power-driven model. The upturned wing tip of No. 7 gives a great degree of automatic stability (lateral), and the longitudinal stability is good. No. 2 glider is placed in the background because it descends at such a steep angle in the lateral stability test. Each glider was put through each of the tests four times. These experiments may be interesting to some of your readers, should you think them worth publishing. My next experiments will be on the stability of high or low centre of gravity models.

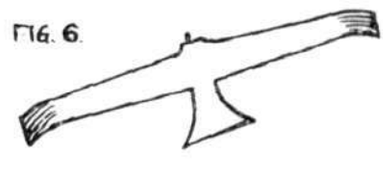












Professor Langley's Model Work.

(*Continued from page* 219).

"By the middle of the year a launch took place with a brief flight, where the model shot down into the water after a flight of a little over 50 yards. It was immediately followed by one in which the same model rose at a considerable incline, and fell backward with scarcely any advance, after sustaining itself for rather less than 10 secs. Both these and subsequent attempts showed that the problem of so disposing the wings that they would not yield, and of obtaining a proper 'balance' was not yet solved.

"Briefly it may be said that the year 1895 gave small results for the labour with which it was filled, and that at its close the outlook for further improvement seemed to be almost hopeless, but it was at this time that final success was drawing near. Shortly after its close I became convinced that substantial rigidity had been secured in the case of the wings; that the frame had been made stronger, without prohibitive weight, and that a degree of accuracy in the balance had been obtained which had not been hoped for. Still there had been such a long succession of disasters and accidents in the launching that hope was low when success finally came.

"I have not spoken yet of the aid which I received from others, and particularly from Dr. Carl Barns and Mr. J. E. Watkins, who have been at different times associated with me in the work. Mr. R. L. Reed's mechanical skill has helped me everywhere, and

the lightness and efficiency of the engines are in large part due to Mr. T. C. Maltby.

"*The Model in Flight.*

"The successful flights of Professor Langley's model were witnessed by Dr. Bell, and are described by him as follows:—

"'Through the courtesy of Dr. S. P. Langley, Secretary to the Smithsonian Institution, I have had, on various occasions, the privilege of witnessing his experiments with flying models, and especially the remarkable success attained by him in the experiments made upon the Potomac River on Wednesday, May 6th, 1896, which led me to urge him to make public some of these results.

"'I had the pleasure of witnessing the successful flights of some of these machines more than a year ago, but Dr. Langley's reluctance to make the results public at that time prevented me from asking him, as I have done since, to let me give an account of what I saw.

"'On the date named two flights were made by the model, or so-called 'flying machine,' which I will not describe here further than to say that it appeared to me to be built almost entirely of metal, and driven by a steam engine, which I have understood was carrying a fuel and water supply for a very brief period, and which was of extraordinary lightness. The absolute weight of the model, including that of the engine and all appurtenances, was, I was told, 25 pounds, and the distance from tip to tip of the supporting surfaces was, as I observed, 12 or 14 ft. The method of propulsion was by aerial screw propellers, and there was no gas or other aid for lifting the machine in the air save its own internal energy.

"'On the occasion referred to, the model, at a given signal, started from a platform about 20 ft. above the water, and rose at first directly in the face of the wind moving at all times with remarkable steadiness, and subsequently swinging round in large curves of perhaps 100 yards in diameter and continually ascending until its steam was exhausted, when at a lapse of about a minute and a half, and at a height which I judged to be between 80 and 100 ft., the propellers ceased rotating, and the machine, deprived of their aid, to my surprise did not fall, but settled [*i.e.*, glided] down so softly and gently that it touched the water without the least shock, and was, in fact, immediately ready for another trial.'" [The model carried a float which prevented it from sinking].

(*To be continued.*)

Suggested Histories of Model Clubs.

Mr. F. J. Camm writes as follows:—"*Re* your note in FLIGHT issue of March 19th, I am at present writing a history of our club (the Windsor Aero Club), and will send the same along as soon as completed."

Mr. W. E. Evans (Hon. Sec. Paddington and Districts Aero Club sends us the following communication:—"In reply to your invitation to secretaries of model clubs to express an opinion on Mr. F. J. Camm's suggestion that the histories of the more progressive model aero clubs should be written up for publication, I certainly think the present time is an opportune one for this work, especially as the K. and M.A.A. competitions are practically suspended for the duration of the war. If these histories were written up accurately, and at the same time in a bright style, I think they would prove highly interesting and instructive to aero model readers of FLIGHT. I, for one, am prepared to undertake to write up the history of the Paddington and Districts Aero Club to the best of my ability from the records of the club in my possession. As I shall have to search as far back as June, 1910, for the founding of this club, I anticipate a considerable amount of work, especially as the earlier records are in a rather chaotic condition; and as my spare time is very limited some weeks must elapse before the work is completed.

"I hope to see the history of the Windsor Aero Club published at an early date, and trust that secretaries of other clubs of several years' standing will shortly follow suit."

Mr. J. W. Reid (Hon. Sec., South-Western Aero Club) writes:—"With reference to Mr. Camm's letter, published in FLIGHT of March 19th, I think his idea is an excellent one. Unfortunately the history of the pioneer work of such a young club as this would not go very far back. Indeed, it is only just completing its first year. However, it is an idea that I think ought to be started, and once started kept up. Not only will it prove a record to look back upon, but it will save a tremendous amount of time and labour for those who are just beginners. The science would be far more advanced than it is if the various pioneer clubs had known each other's 'conclusions.'"

We shall be glad to hear from the secretaries of other model clubs, no matter what their views may be.

There is one absolutely essential feature of these histories, and that is, they *must* be illustrated, either with photographs, drawings, or, at any rate, rough sketches which can be worked up; more especially does this hold good of any models which were what I should term more especially *typical of the club*, and all such must be carefully *acted*, this is absolutely necessary for them to have any real value.

Also the club need not of necessity be one which is at present in existence; much excellent pioneer work was done by clubs which are (at present) dead and buried, but their work remains if it can only be resuscitated.

Particulars of typical machines should be as full as possible, and scale drawings, where possible, would be of the greatest value.

AFFILIATED MODEL CLUBS DIARY.

Club reports of chief work done will be published monthly for the future. Secretaries' reports, to be included, must reach the Editor on the last Monday in each month.

N.E. London Model Ae.C. (47, JENNER RD. STOKE NEWINGTON, N.)
THE first competitions for the year will be held on Saturday, April 3rd, when a competition for single-screw tractor biplanes will be held, duration being the deciding factor. A duration sweepstake will also be held.

Stony Stratford and District Kite and Model Ae.C. (OLD STRATFORD).
APRIL 7TH, members meeting at 8 p.m.

UNAFFILIATED CLUB.

Liverpool Aero Research Club (62, CEDAR GROVE, LIVERPOOL).
APRIL 3RD, at Clubmoor, 3 p.m. Easter Monday, third (postponed) Trophy Competition for r.o g. pusher biplanes, at Clubmoor; start, 2.30 p.m. prompt.

"The Airman."

IN view of the large number of those who are now training to take their place in the British air services and those who are thinking of doing so, many of whom would like to know something of the inner side of the work at a flying school, attention may be directed to a little book entitled "The Airman" which was reviewed in our columns some months ago. Written by Capt. Mellor, R.E., the book describes his experiences while training for his *brevet* at the Farman school in France, and that it is trustworthy is shown by the fact that it has the *cachet* of Mr. Maurice Farman. It does not profess to teach anyone how to fly, but to those who contemplate joining a school it should prove useful and enable them to avoid many mistakes.

There are several photographic illustrations, and the price of the book, which is published by Mr. John Lane, is 3*s.* 6*d.* net.

Triplex Safety Goggles.

IN reply to a number of enquiries as to the makers of the Triplex Safety Goggles, a remarkable demonstration of the qualities of which was illustrated in our last issue, it may be as well to state that enquiries should be addressed to the Triplex Safety Glass Co., Ltd., 1, Albemarle Street, W.

Aeronautical Patents Published.

Applied for in 1914.

Published April 1st, 1915.

19,172. E. ZOLLINGER. Photographic apparatus for use in in aerial navigation.

Applied for in 1915.

Published March 25th, 1915.

280. ROONEY. Construction of aeroplanes.

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44, ST. MARTIN'S LANE, LONDON, W.C.
Telegraphic address: Truditur, London. Telephone: 1828 Gerrard.

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